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(73) Proprietor: Toray Silicone Company Limited
2-8 Nihonbashi Muromachi
Chuo-ku Tokyo 103 (JP)

(72) Inventor: Hamada, Mitsuo
3-5-17 Ohkubo
Kisaratsu-shi Chiba-ken (JP)
Inventor: Yasuda, Sadami
2427 Anesaki
Ichihara-shi Chiba-ken (JP)

(74) Representative: Laredo, Jack Joseph et al
Elkington and Fife High Holborn House 52/54
High Holborn
London, WC1V 6SH (GB)

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Description

The present invention relates to a primer composition which has excellent adhesive properties. More specifically, it relates to a primer composition suited to adhering silicone rubber of the heat-curing type, particularly fluorosilicone rubber, to various types of substrates, such as metal surfaces.

The Japanese Patent Publication No. Sho 49[1974]—5730 describes using vinyl-tris(tert-butylperoxy)silane as a primer for adhering EPDM, EPR, chlorinated polyethylene, or silicone rubber to surfaces of glass and metal. However, this primer exhibits drawbacks such as the necessity of long-term heat treatment at an elevated temperature and pressure. For this reason, the Japanese Patent No. Sho 50[1975]—35,530, proposes an adhesive primer composition which can be used as a primer for attaching thermoplastic resins to each other or attaching thermoplastic resin to glass, metals, or metal oxides at low temperatures in a short period of time. This primer composition is composed of vinyltris-(tertiary-butylperoxy)silane, an organoperoxide whose half-life is 1 minute at 130—190°C, and an inert organic solvent. However, this primer composition exhibits slow air-drying and slow thermosetting properties after it has been coated over with a material to be attached. Therefore, the primary layer coated on the material surface moves from one location to another location by press insertion of material during injection- or press-molding processes. For this reason, this primar composition exhibits not only drawbacks such as difficulty in achieving uniform adhesion, but also the drawback of interfacial delamination which can be detected by inspection of the adhesion properties of silicone rubber, especially fluorosilicone rubber as a material to be attached. For this reason, this primer composition is unsatisfactory for attaching silicone rubber to a substrate, especially for attaching fluorosilicone rubber to a substrate.

As a result of extensive investigations to improve the above-mentioned drawbacks, the present inventors were able to perfect a primer composition which air dries and cures well, with which an adhesion effect is obtained by thermocompression bonding at comparatively low temperatures and in a short period of time, and which is effective in adhering silicone rubber to a substrate, particularly in adhering fluorosilicone rubber to a substrate.

Union Carbide Corporation in their U.K. Patent No. 872,929 describe attempts to improve the bonding at a high temperature between certain metals and polymeric materials including amongst others silicone rubbers and resins. The patent teaches that the adherence between the polymeric material and the metal can be improved by treating the surface of the metal with an aminoalkylsilicon compound to form a thin film thereon before the polymeric material is bonded to the metal. The aminoalkyl silicon compound contains the group $=N—R—Si\equiv$ in which R is a divalent hydrocarbon radical, at least three carbon atoms separate the nitrogen and silicon atoms, each of the free bonds of the nitrogen atom is attached to hydrogen, a hydrocarbon radical, or the radical $—R—Si\equiv$, and at least one free bond of the silicon atom is attached through an oxygen atom to an alkyl radical or a silicon atom and the remaining free bonds of the silicon atoms are attached to hydrocarbon radicals. Amongst the numerous examples given of aminoalkylsilicon compounds are aminoalkylalkoxysilanes such as gamma-aminopropyltriethoxysilane, gamma-aminopropyltripropoxysilane and gamma-aminopropylmethyldiethoxysilane and aminoalkylpolysiloxanes which may be prepared by the hydrolysis and condensation of the aminoalkylalkoxysilanes described above. Various methods may be used to apply the aminoalkylsilicon compounds to the metal surface including the use of solutions in various solvents including methanol, ethanol and propanol and mixtures of, for example, toluene with the monomethylether of ethyleneglycol.

The European Patent Application No. 0051363 describes an adhesive primer composition for bonding thermosetting type silicon rubbers, especially fluorosilicone rubbers, to various substrates such as metal surfaces. The composition comprises a mixture of an organosilicon compound having at least one OR^2 group per molecule where R^2 is alkoxy or alkoxyalkyl, vinyltris(tertiary-butylperoxy)silane and an organic solvent. The organosilicon compounds may be silanes or polysiloxanes containing at least one OR^2 group per molecule, including tetraalkoxysilanes, organoalkoxysilanes, alkyl polysilicates and organoalkoxy-polysiloxanes including partially hydrolyzed-products of organoalkoxysilanes, which may be linear cyclic or branched, which may or may not form network structures and which may be homopolymers or copolymers. The preferred such organosilicon compounds have at least three OR^2 groups per molecule, the most preferred being *n*-propylorthosilicate, ethylpolysilicate, methylcellosolve orthosilicate, vinyltrimethoxysilane, vinyltriethoxysilane, gammamethacryloxypropyltrimethoxysilane and gamma-methacryloxypropyltriethoxysilane.

This invention relates to a primer composition for adhering silicone rubber to a substrate comprising:

(a) 100 parts by weight of an alkoxy containing silicon compound selected from the group consisting of an alkoxysilane represented by the formula

$$R_aR'_bSi(OR^2)_c$$

wherein R is a monovalent radical selected from the group consisting of alkyl radicals, halogenated alkyl radicals, and aryl radicals; R' is a monovalent radical selected from the group consisting of alkenyl

radicals and XR^3-radicals in which X is a monovalent radical selected from the group consisting of acryloxy radical, methacryloxy radical, N-aminoalkylamino radical, amino radical, N-alkylamino radical, epoxy radical, and mercapto radical, and R^3 is a divalent radical selected from the group consisting of hydrocarbon radicals, halogenated hydrocarbon radicals, hydroxyhydrocarbon radicals and ether radicals; R^2 is an alkyl radical or an alkoxyalkyl radical; *a* has a value of 0 to 2 inclusive; *b* has a value of 0 to 2 inclusive; *c* has a value of 2 to 4 inclusive; the sum of $a+b+c$ is 4; and partial hydrolysis condensates of at least one alkoxysilane defined above where said condensate contains at least two alkoxy radicals per molecule, and

(B) an organic solvent, characterised in that said primer composition also contains,

(C) from 0.5 to 50 parts by weight of a hydroperoxide.

The alkoxy containing silicon compound of (A) can be an alkoxysilane or a partial hydrolysis condensate of at least one of the alkoxysilanes. The alkoxysilanes are tetraalkoxysilanes, organotrialkoxysilanes, or diorganodialkoxysilanes, which can be expressed by the general formula

$$R_aR'_bSi(OR^2)_c$$

where R is an alkyl radical such as methyl, ethyl, propyl, or octyl; a halogenated alkyl radical such as 3,3,3-trifluoropropyl; or an aryl radical such as phenyl; R′ is an alkenyl radical such as vinyl or allyl, or a radical represented by XR^3— where X is a monovalent radical selected from acryloxy radical, methacryloxy radical, N-amonoalkylamino radical, amino radical, N-alkylamino radical, epoxy radical, and mercapto radical; and R^3 is a divalent radical selected from divalent hydrocarbon radicals such as methylene, ethylene, propylene, and phenylene, divalent halogenated hydrocarbon radicals such as chloroethylene and fluoroethylene, divalent hydroxyhydrocarbon radicals, and divalent ether radicals such as

$$—CH_2OCH_2CH_2CH_2—,$$

$$—CH_2CH_2OCH_2CH_2—,$$

$$—CH_2CH_2O\overset{\overset{\large CH_3}{|}}{C}HCH_2—, \quad \text{and}$$

$$CH_2OCH_2CH_2OCH_2—.$$

R^2 is an alkyl radical such as methyl, ethyl, propyl, butyl, pentyl, octyl, and decyl or an alkoxyalkyl radical such as beta-methoxyethyl. In the alkoxysilane, *a* can be 0, 1, or 2; *b* can be 0, 1, or 2; *c* can be 2, 3, or 4; and the sum of $a+b+c$ is 4. Mixtures of the alkoxysilanes can be used.

The partial hydrolysis condensate of the alkoxysilanes are siloxanes which can be straight chain, ring structure, branched chain, three-dimension structures, or mixtures of these structures. The partial hydrolysis condensate is made by partially hydrolyzing one or more of the alkoxysilanes such that there is at least two alkoxy radicals per molecule in the resulting condensate. The condensate is usually a liquid at normal temperatures.

The preferred alkoxy containing silicon compounds of (A) are alkoxysilanes of the formula

$$R'Si(OR^2)_3$$

and partial hydrolysis condensates with one or more R′ radicals and 3 or more alkoxy radicals per molecule. These preferred (A) in the primer compositions of this invention exhibit the best combination of adhesive properties and air dryability.

Examples of alkoxysilanes of (A) include vinyltrimethoxysilane, methylvinyldimethoxysilane, vinyltriethoxysilane, vinyl-tris(β-methoxyethoxy)silane, γ-methacryloxypropyltrimethoxysilane, γ-methacryloxypropylmethyldimethoxysilane, γ-methacryloxypropyltriethoxysilane, γ-acryloxypropyltriethoxysilane, allyltrimethoxysilane, allyltriethoxysilane, allylmethyldiethoxysilane, γ-mercaptopropyltrimethoxysilane, γ-mercaptopropylmethyldimethoxysilane, N-β-(aminoethyl)-γ-aminopropyltrimethoxysilane, γ-aminopropyltriethoxysilane, γ-aminopropylmethyldiethoxysilane, γ-mercaptopropyltriethoxysilane, mercaptoethyltriethoxysilane, γ-aminopropyltrimethoxysilane, γ-glycidoxypropyltrimethoxysilane, γ-glycidoxypropylmethyldimethoxysilane, β-(3,4-epoxycyclohexyl)ethyltrimethoxysilane, tetramethoxysilane, tetraethoxysilane, tetrapropoxysilane, and tetrabutoxysilane.

The hydroperoxide of component (B) used in the present invention is represented by hydrogen peroxide, methyl hydroperoxide, ethyl hydroperoxide, n-butyl hydroperoxide, 2,4,4-trimethylpentyl-2-hydroperoxide, diisopropylbenzene hydroperoxide, cumene hydroperoxide, t-butyl hydroperoxide, cyclohexyl hydroperoxide, and 2-methyl-2-cyclohexen-1-yl hydroperoxide. Component (B) is limited to hydroperoxides because organic peroxides such as ketone peroxides, diacyl peroxides, dialkyl peroxides, peroxyketals, alkyl peresters, and percarbonates do not provide adequate adhesive force when present

with component (A). Component (B) is an essential component in order to further improve the adhesive force when component (A) is also present. The mixing ratio is 0.5—50 parts by weight, preferably 5—30 parts by weight with respect to 100 parts by weight of component (A). When this mixing ratio is less than 0.5 part by weight, a strong adhesive force is not obtained; when it is more than 50 parts by weight, a decline is brought about in air dryability and adhesive strength.

The component (C) used in the present invention is an organic solvent for the purpose of dissolving the composition of the present invention, and it is selected with due consideration to solubility and to its vaporization properties when applied as a primer. Toluene, xylene, benzene, heptane, hexane, rubber solvent, and trichloroethylene, for example, can be mentioned, but it is not limited to these alone. One variety of organic solvent can be used, or a mixed solvent of two or more varieties can be used. The mixing ratio is not particularly limited because it is advantageous to adjust it to the viscosity suited to application as primer.

The composition of the present invention is easily obtained merely by uniformly mixing the above-mentioned components, (A), (B), and (C). But for purposes of improving the material properties of the coat after hardening, one can add various inorganic fillers; for example, fumed silica, precipitated silica, quartz micro powder, diatomaceous earth, calcium carbonate, red iron oxide, cerium oxide, titanium oxide, alumina, and carbon black, and also conventionally well-known heat resistant agents; coloring agents and other additives, such as organic esters of titanic acid. Also, one or more varieties of organosilanes and organopolysiloxanes other than component (A) may be included.

When using the composition of the present invention, it is desirable to adhere the silicone rubber after it has air dried 30 minutes or longer following application to the substrate.

Examples of substrates include metals such as iron, aluminum, copper, zinc, stainless steel, brass, and bronze; plastics such as epoxy resins, vinyl chloride resins, polyester resins, and polyamide resins; and inorganic materials such as glass, mortar, and asbestos. Silicone rubber which is to be adhered to the substrate is obtained from a heat-curing silicone rubber composition whose principal ingredients are organic peroxides, fillers, and polymers, copolymers, or mixtures thereof, whose repeating units include dimethylsiloxane, methylphenylsiloxane, diphenylsiloxane, methylvinylsiloxane, phenylvinylsiloxane, 3,3,3-trifluoropropylmethylsiloxane, 3,3,3-trifluoropropylvinylsiloxane, and 3,3,3-trifluoropropylphenylsiloxane. In particular, the primer composition of the present invention is ideal for the adhesion of fluorosilicone rubber that contains fluorinated hydrocarbon groups such as 3,3,3-trifluoropropyl groups which are difficult to adhere with ordinary primers.

The composition of the present invention is especially useful as a primer and is also useful for the adhesion of silicone rubbers other than those mentioned above and for the adhesion of natural or synthetic rubbers to silicone rubber. In addition, it can be used as a coating agent, added to various rubbers, resins, baking paints, etc., as adhesion improvers, and can itself be used as an adhesive, curable material.

In the following examples "parts" indicates "parts by weight" and the viscosity is the value measured at 25°C.

Example 1

Various primer compositions having the components and mixing ratios shown in Table I were prepared and applied respectively in a thin coat on metal plates of aluminum, phosphor bronze, and stainless steel and then left alone to air dry for 60 minutes at room temperature. Other than the ingredients shown in Table I, each of the primer compositions also contained 1000 parts of rubber solvent which is a naptha having a boiling point range of 43°C to 140°C. A 4 mm thick unvulcanized molding of a fluorosilicone rubber composition (LS-422 base manufactured by Dow Corning Corporation, Midland, Michigan, U.S.A.), to which 0.5%, 2,5-dimethyl-2,5-di(t-butyl peroxide)hexane was added as cross-linking agent, was placed on the primed substrate surface and made to adhere to the metal plate while simultaneously curing the fluorosilicone rubber composition by heating it for 10 minutes at 170°C under pressure of 30 kg/cm^2. Then the adhesion state was examined by peeling apart the fluorosilicone rubber and metal plate. Also, the air drying situation 60 minutes after application of the primer to the metal plate was investigated. The ones judged dry to the touch were indicated by O and those judged sticky were indicated with an X. These results are shown in Table I.

TABLE I

	The present invention		Comparison Examples				
Experiment No.	1	2	1	2	3	4	5
Components							
(A) Vinyltrimethoxylsilane (parts)	100	100	100	100	100	—	—
(B) 2,4,4-trimethylpentyl-2-hydroperoxide (parts)	10	30	—	—	—	—	—
1,1-di-t-butylperoxy-3-3-5-trimethyl-cyclohexane (parts)	—	—	30	—	—	—	—
di-t-butyl peroxide (parts)	—	—	—	40	—	—	50
2,4-dichlorobenzoyl peroxide (parts)	—	—	—	—	15	—	—
Vinyl-tris(t-butyl peroxide)silane (parts)	—	—	—	—	—	100	100
Adhesion state on substrate Aluminum phosphor bronze, stainless steel	***	***	*	*	*	**	*
Air dryability of primer	O	O	O	O	O	X	X

* Interfacial peeling in each case
** Thin layer cohesive failure in each case
*** 100% cohesive failure in each case

Example 2

Various primer compositions with the components and mixing ratios shown in Table II were prepared; the primer was applied using metal plates similar to those of Example 1 and dried for 60 minutes at room temperature. Other than the ingredients listed in Table II, each primer composition also contained 1000 parts of rubber solvent as defined in Example 1. A 4 mm thick unvulcanized molding of a dimethylsilicone rubber composition (SH-52U manufactured by Toray Silicone Co., Tokyo, Japan), to which 0.7% 2,4-dichlorobenzoyl peroxide was added as cross-linking agent, was placed on the primed substrate surface, and dimethylsilicone rubber was adhered to the metal plate by heating for 5 minutes at 120°C at a pressure of 30 kg/cm^2. The adhesion state and air dryability of the primer were investigated in the same manner as Example 1, and the results are shown in Table II.

TABLE II

	The present invention				
Experiment No.	3	4	5	6	7
Components					
(A) N-β(aminoethyl-γ-aminopropyl)trimethoxysilane (parts)	100	—	—	—	—
γ-glycidoxypropyltrimethoxysilane (parts)	—	100	—	—	50
γ-methacryloxypropyltrimethoxysilane (parts)	—	—	100	—	50
γ-mercaptopropyltrimethoxysilane (parts)	—	—	—	100	—
(B) 2,4,4-trimethylpentyl-2-hydroperoxide (parts)	15	20	25	20	5
Adhesion state on substrate Aluminum, phosphor bronze, stainless steel	***	***	***	***	***
Air dryability of primer	O	O	O	O	O

*** 100% cohesive failure in each case

Example 3

The adhesion state and air dryability of the primer composition shown in Table III (using 1000 parts toluene as organic solvent in each case) were investigated in the same manner as Example 1. The results are shown in Table III. Excellent adhesive properties were exhibited in each case.

TABLE III

Experiment No.	The present invention 8	9
Components		
(A) $CH_2{=}CH{-}Si(CH_3)(OC_2H_5){-}O{-}Si(CH_3)(OC_2H_5){-}O{-}Si(CH_3)(OC_2H_5){-}CH_3$ (parts)	100	—
Liquid organopolysiloxane resin (Note 1) (parts)	—	100
(B) Cumene hydroperoxide (parts)	10	20
Adhesion state on substrate Aluminium, phosphor bronze, stainless steel	***	***
Air dryability of primer	O	O

Note 1: Liquid organopolysiloxane resin with a viscosity of 2 Pa·s, an alkoxy group content of 10% by weight, and obtained by hydrolysis of $CH_3Si(OCH_3)_3$ (60 mol%), $(CH_3)(CH_2{=}CH)Si(OC_2H_5)_2$ (30 mol%), and $(C_6H_5)_2Si(OCH_3)_2$ (10 mol%).

*** 100% cohesive failure in each case

Claims

1. A primer composition for adhering silicone rubber to a substrate comprising:

(A) 100 parts by weight of an alkoxy containing silicon compound selected from the group consisting of an alkoxysilane represented by the formula

$$R_aR'_bSi(OR^2)_c$$

wherein R is a monovalent radical selected from the group consisting of alkyl radicals, halogenated alkyl radicals, and aryl radicals; R' is a monovalent radical selected from the group consisting of alkenyl radicals and XR^3—radicals in which X is a monovalent radical selected from the group consisting of acryloxy radical, methacryloxy radical, N-aminoalkylamino radical, amino radical, N-alkylamino radical, epoxy radical, and mercapto radical, and R^3 is a divalent radical selected from the group consisting of hydrocarbon radicals, halogenated hydrocarbon radicals, hydroxyhydrocarbon radicals and ether radicals;; R^2 is an alkyl radical or an alkoxyalkyl radical; *a* has a value of 0 to 2 inclusive; *b* has a value of 0 to 2 inclusive; *c* has a value of 2 to 4 inclusive; the sum of $a+b+c$ is 4; and partial hydrolysis condensates of at least one alkoxysilane defined above where said condensate contains at least two alkoxy radicals per molecule, and

(B) an organic solvent, characterised in that said primer composition also contains

(C) from 0.5 to 50 parts by weight of a hydroperoxide.

2. The primer composition according to claim 1 in which the condensate is a liquid organopolysiloxane resin having a viscosity of 2 Pa·s, an alkoxy content of 10 percent by weight, and obtained by the partial hydrolysis of a mixture composed of 60 mol percent methyltrimethoxysilane, 30 mol percent methylvinyldiethoxysilane, and 10 mol percent diphenyldimethoxysilane.

3. A method for adhering silicon rubber to a substrate characterised in that it requires coating the substrate with a primer composition, air drying the coating for at least 30 minutes to form a primer coated substrate, applying a heat curable silicone rubber composition over the primer coated substrate to make an assembly, heating the assembly to a temperature which cures the silicone rubber composition, and a silicone rubber bonded to the substrate is obtained, said primer composition being as defined in claim 1 or 2.

Revendications

1. Une composition d'apprêt pour faire adhérer du caoutchouc de silicone à un substrat, qui comprend:

(A) 100 parties en poids d'un composé du silicium alcoxylé choisi dans le groupe constitué d'un alcoxysilane représenté par la formule

$$R_aR'_bSi(OR^2)_c$$

où R est un radical monovalent choisi dans le groupe constitué des radicaux alcoyle, des radicauz alcoyle halogéné et des radicaux aryle; R' est un radical monovalent choisi dans le groupe constitué des radicaux alcényle et des radicaux XR^3— où X est un radical monovalent choisi dans le groupe constitué du radical acryloxy, du radical méthacryloxy, du radical N-aminoalcoylamino, du radical amino, du radical N-alcoylamino, du radical époxyde et du radical mercaptan, et R^3 est un radical divalent choisi dans le groupe constitué des radicaux d'hydrocarbures, des radicaux d'hydrocarbures halogénés, des radicaux d'hydrocarbures hydroxylés et des radicaux éther; R^2 est un radical alcoyle ou un radical alcoxyalcoyle; *a* vaut de 0 à 2 inclusivement; *b* vaut de 0 à 2 inclusivement; *c* vaut de 2 à 4 inclusivement; la somme $a+b+c$ est égale à 4; et des produits de condensation par hydrolyse partielle d'au moins un alcoxysilane défini ci-dessus où ledit produit de condensation contient au moins deux radicaux alcoxy par molécule, et

(B) un solvant organique, caractérisée en ce que cette composition d'apprêt contient aussi

(C) de 0,5 à 50 parties en poids d'un hydroperoxyde.

2. Une composition d'apprêt selon la revendication 1, dans laquelle le produit de condensation est une résine d'organopolysiloxane liquide ayant une viscosité de 2 Pa.s, une teneur en groupes alcoxy de 10% en poids, obtenue par hydrolyse partielle d'un mélange composé de 60 mol% de méthyltriméthoxysilane, de 30 mol% de méthylvinyldiéthoxysilane, et de 10 mol% de diphényldiméthoxysilane.

3. Un procédé pour faire adhérer du caoutchouc de silicone à une substrat, caractérisé en ce qu'il comprend le revêtement du substrat avec une composition d'apprêt, le séchage à l'air du revêtement pendant au moins 30 minutes pour former un substrat apprêté, l'application d'une composition de caoutchouc de silicone thermovulcanisable sur le substrat apprêté pour faire un ensemble, le chauffage de cet ensemble à une température qui vulcanise la composition de caoutchouc de silicone de manière à obtenir un caoutchouc de silicone lié au substrat, ladite composition d'apprêt étant telle que définie à la revendication 1 ou 2.

Patentansprüche

1. Eine Grundiermittelzusammensetzung zum Verkleben eines Siliconkautschuks mit einem Substrat, enthaltend

(A) 100 Gewichtsteile einer alkoxyhaltigen Siliciumverbindung ausgewählt aus der Gruppe bestehend aus einem Alkoxysilan der Formel

$$R_aR'_bSi(OR^2)_c$$

in der R ein einwertiger Rest, ausgewählt aus der Gruppe bestehend aus Alkylresten, halogenierten Alkylresten und Arylresten ist; R' ein einwertiger Rest, ausgewählt aus der Gruppe bestehend aus Alkenylresten und XR^3— Resten ist, wobei X ein einwertiger Rest ist, ausgewählt aus der Gruppe bestehend aus Acryloxyresten, Methacryloxyresten, N-Aminoalkylaminoresten, Aminoresten, N-Alkylaminoresten, Epoxyresten und Mercaptoresten, und R^3 ein zweiwertiger Rest ist, ausgewählt aus der Gruppe bestehend aus Kohlenwasserstoffresten, halogenierten Kohlenwasserstoffresten, Hydroxykohlenwasserstoffresten und Etherresten; R^2 ein Alkylrest oder ein Akoxyalkylrest ist; *a* einen Wert von 0 bis einschliesslich 2 hat; *b* einen Wert von 0 bis einschliesslich 2 hat; *c* einen Wert von 2 bis einschliesslich 4 hat; die Summe von $a+b+c$ 4 ist; und partielle Hydrolysekondensate von mindestens einem oben definierten Alkoxysilan, wobei dieses Kondensat mindestens zwei Alkoxyreste pro Molekül enthält und

(B) ein organisches Lösungsmittel, dadurch gekennzeichnet, dass diese Grundierzusammensetzung zusätzlich

(C) 0.5 bis 50 Gewichtsteile eines Hydroperoxids enthält.

2. Die Grundierzusammensetzung nach Anspruch 1, dadurch gekennzeichnet, dass das Kondensat ein flüssiges Organopolysiloxanharz mit einer Viskosität von 2 Pa·s ist einen Alkoxygehalt von 10 Gew% hat und durch partielle Hydrolyse einer Mischung erhalten wurde, die aus 60 Molprozent Methyltrimethoxysilan, 30 Molprozent Methylvinyldiäthoxysilan und 10 Molprozent Diphenyldimethoxysilan zusammengesetzt ist.

3. Ein Verfahren zum Verkleben von Silikonkautschuk mit einem Substrat, dadurch gekennzeichnet, dass es erfordert: Überziehen des Substrats mit einer Grundiermittelzusammen-

setzung, Lufttrocknen des Überzuges für mindestens 30 Minuten, um ein mit dem Grundiermittel überzogenes Substrat zu bilden, Auftragen einer wärmehärtbaren Silikonkautschukzusammensetzung über das mit dem Grundiermittel überzogene Substrat, um einen zusammengesetzten Körper zu bilden, Erwärmen des zusammengesetzten Körpers auf eine Temperatur, bei der die Silikonkautschukzusammensetzung aushärtet und ein mit dem Silikonkautschuk verbundenes Substrat erhalten wird, wobei die Grundiermittelzusammensetzung wie in Anspruch 1 oder 2 definiert ist.